

# Effect of Sulphite in Dehydrated Foods on Thiamine Content of a Diet<sup>1</sup>

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NUTRITIONAL problems which ordinarily come to mind in connection with the use of dehydrated foods are those concerned with palatability, attractiveness, stability, and other similar factors influencing the amount of food eaten. However, the amount of sulphite used as a preserving agent is not usually given as much consideration. For toxicologic reasons, maximum legal levels have been established for sulphite found in dehydrated foods (1-5); examples are given in Table 1.

TABLE 1  
Legal levels for sulphite in dehydrated foods (1-5)

DEHYDRATED FOOD	AMOUNT OF SULPHITE	
	Not less than	Not more than
	p.p.m.	p.p.m.
Potatoes, diced or sliced	200	500
Cabbage	750	1500
Carrots	500	1000
Potatoes, riced or shredded		300
Peaches	2500	4000
Apricots	3000	4500

Several years ago it was found that the use of sulphurous acid as a preservative against bacterial decay of rice polish extracts led to a complete loss of its antineuritic activity. Williams and associates (6) found that crystalline thiamine dissolved in two parts of sodium sulphite solution at pH 1 and pH 4 and kept at room temperature for 36 hr. would lose about half its antineuritic activity at pH 1 and all its activity at pH 4. At pH 5, the reaction was completed after 24 to 48 hr. at room temperature; at steam bath temperature, within 1 hr.

<sup>1</sup> This paper reports research undertaken in cooperation with the Quartermaster Food and Container Institute for the Armed Forces and has been assigned number 255 in the series of papers approved for publication. The views and conclusions contained in this report are those of the authors. They are not to be construed as necessarily reflecting the view or indorsement of the Department of the Army. Received for publication April 29, 1949.

It would seem unlikely, therefore, that sulphited foods would be a potent source of thiamine. However, the possibilities of destroying thiamine extend beyond the amount contained in the dehydrated food itself. A question arises concerning the effect upon the total thiamine content of a meal which contains the dehydrated type of food. It is not unreasonable to imagine that when such a meal is mixed in the acid medium of the stomach, some of the thiamine of the entire stomach contents might be destroyed. This possibility seemed real where military rations are concerned, because certain of the components are fortified by the addition of crystalline thiamine—the form of the vitamin which might be quite susceptible to destruction by sulphite. Such rations presumably adequate in thiamine might not be so in reality.

## EXPERIMENTAL PROCEDURE AND RESULTS

The method first suggested for testing this possibility was to carry out comparative excretion studies in the presence and absence of dehydrated sulphited foods in the diet. Before doing this, however, it was deemed advisable to carry out preliminary laboratory studies to learn more of the degree of thiamine destruction that could be expected. Ultimately it was decided that the balance type of study was not necessary. The reasons for this decision will be apparent from the results presented below.

As a first step, model systems containing graded amounts of sodium sulphite ( $\text{Na}_2\text{SO}_3$ ) were investigated in order to determine the effect of sulphite on the stability of thiamine buffered at pH 5.5. Solutions of 10, 30, 60 mcg. per milliliter concentration were treated with 500 to 10,000 p.p.m. (parts per million) of sodium sulphite and then analyzed (7) both immediately and following 18 hr. of storage at 100°F. The only appreciable loss of thiamine occurred initially in those solutions containing 5,000, 6,000, and 10,000 p.p.m. However, after 18 hr. of storage at 100°F., the solutions had lost from 45 to 77 per cent of their original thiamine concentration in the

presence of only 500 p.p.m.—the greatest loss occurring at the highest concentration of thiamine. In Table 2 are shown the overall results.

The next step was to determine what amount of sulphite would cause destruction of thiamine in an average meal which supplied approximately 0.7 mg. thiamine. Hamburgers, peaches, and crackers were

TABLE 2

Percentage retention of thiamine at pH 5.5  
in the presence of sodium sulphite

CONCENTRATION OF SODIUM SULPHITE	THIAMINE RETENTION			
	0 storage time*	18 hr. storage time*	36 hr. storage time*	54 hr. storage time*
Thiamine Concentration: 10 mcg./ml.				
p.p.m.	%	%	%	%
None	100	98	100	101
500	98	47	56	45
1000	97	38	42	38
2500	91	26	18	
5000	90	8		
6000	85	0		
10,000	78	0		
Thiamine Concentration: 30 mcg./ml.				
None	100	106	101	100
500	102	55	35	27
1000	98	30	24	23
2500	92	1		
5000	88	0		
6000	83	0		
10,000	77	2		
Thiamine Concentration: 60 mcg./ml.				
None	100	100	99	
500	95	23	16	
1000	91	4		
2500	89	1		
5000	80	0		
6000	79	0		
10,000	80	1		

\* At 100°F.

selected from the Army C ration for this experiment—the crackers being fortified with synthetic thiamine. A large sample was homogenized in a Waring Blendor, aliquots removed, and sulphite added from 0 to 30,000 p.p.m. per gram of equivalent dehydrated fruit.<sup>2</sup> Samples were then blended 15 min. under nitrogen before analysis for thiamine.

Figure 1 shows that the amount of sulphite necessary to cause complete destruction of the total thiamine was 30,000 p.p.m. However, there was between 15 and 35 per cent loss of thiamine in the presence of 4000 to 4500 p.p.m. of sulphite—the highest existing tolerance of sulphite in individual dehydrated

foods. Sulphite present in 3000 p.p.m. concentration caused only a 15 per cent loss of thiamine.

It can be calculated that even if an individual sulphited fruit or vegetable contained 4500 p.p.m. (and most of these items have a legal maximum of considerably less than this), dilution by other foods would decrease the overall concentration so that little or no destruction of thiamine would be likely.

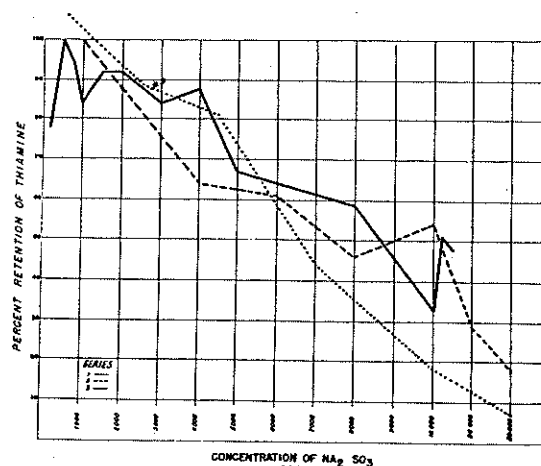


FIG. 1. Percentage retention of thiamine in food in the presence of sodium sulphite.

Furthermore, one of the effects of rehydration and cooking of dehydrated foods is to cause conversion of a considerable amount of sulphite to sulphate. The latter does not destroy thiamine (6). Thus it was concluded there will be no significantly deleterious effect on total thiamine intake arising from (sulphited) dehydrated fruits and vegetables.

#### SUMMARY

It is unlikely that the level of sulphite encountered in the usual ration or diet would be enough to cause nutritionally significant destruction of the total thiamine content of a meal.

#### REFERENCES

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<sup>2</sup> The weight of canned peaches in the sample was converted to its equivalent weight of dehydrated fruit.